

WHAT IS CLAIMED IS:

1. A method for performing an electrochemiluminescence binding assay in which a complex is formed, said complex including, at least, a particle and a label compound capable of electrochemiluminescence, comprising the steps of:

- (a) forming said complex;
- (b) collecting said complex by filtration on a porous, conductive electrode;
- (c) inducing the said label compound in said collected complex to luminesce by imposing a voltage on said electrode; and
- (d) detecting the emitted luminescence from the electrode.

2. A method as recited in claim 1 wherein said porous, conductive electrode is comprised of carbon.

3. A method as recited in claim 1 wherein said electrode is comprised of a mat of carbon fibrils.

4. A method as recited in claim 1 wherein said particle contains a luminescent species capable of acting as an internal standard in said assay and the luminescence thereof is measured to calibrate the said assay.

5. A method for performing an electrochemiluminescence binding assay for an analyte of interest in which a complex is formed, said complex including, at least, a

particle and a label compound capable of electrochemiluminescence, comprising the steps of:

(a) collecting a particle capable of complexing with a component of an electrochemiluminescence assay on a porous, conductive electrode;

(b) passing a sample containing said analyte of interest through said porous, conductive electrode and forming said complex at said porous, conductive electrode;

(c) inducing the said label compound in said complex to luminesce by imposing a voltage on said electrode; and

(d) detecting the emitted luminescence from the electrode to measure the presence of the analyte of interest.

6. A method for performing an electrochemiluminescence binding assay for an analyte of interest in which a complex is formed, said complex including, at least, a particle and a label compound capable of electrochemiluminescence, comprising the steps of:

(a) passing a sample containing said analyte of interest through a porous, conductive electrode containing a particle capable of complexing with a component of an electrochemiluminescence assay and forming said complex at said porous, conductive electrode;

(b) inducing the said label compound in said complex to luminesce by imposing a voltage on said electrode; and

(c) detecting the emitted luminescence from the electrode to measure the presence of the analyte of interest.

7. A method for performing a plurality of electrochemiluminescence binding assays for a plurality of analytes of interest in which a plurality of complexes are formed, each of said complexes including, at least, a particle and a label compound capable of electrochemiluminescence, comprising the steps of:

(a) collecting said plurality of complexes on a plurality of domains, each of said domains including a porous, conductive electrode;

(b) inducing the label compound in one or more of said plurality of domains to luminesce by imposing a voltage on the electrodes associated with said domain; and

(c) detecting the emitted luminescence from the assay domains to detect the presence analytes of interest therein.

8. A method for performing a plurality of electrochemiluminescence binding assays for a plurality of analytes of interest in which a plurality of complexes are formed, each of said complexes including, at least, a particle and a label compound capable of electrochemiluminescence, comprising the steps of:

(a) collecting a plurality of particles on a plurality of domains on a porous, conductive electrode;

(b) passing a sample containing said analyte of interest through said plurality of domains on said porous, conductive electrode and forming complexes on said domains;

(c) inducing the said label compounds in said complexes in one or more of said domains to luminesce by imposing a voltage on the electrodes associated with said domain; and

(d) detecting the emitted luminescence from the assay domains to detect the presence of analytes of interest therein.

9. A composition of matter for the conduct of an electrochemiluminescence assay comprising: a porous electrode having a plurality of particles incorporated therein.

10. A composition of matter for the conduct of an electrochemiluminescence assay comprising: a porous electrode having a plurality of particles incorporated therein, said particles being capable of complexing with a component of an electrochemiluminescence assay, said assay including at least a compound capable of electrochemiluminescence.

11. A composition of matter comprising: a porous electrode having a plurality of particles incorporated therein, said particles being complexed with a component of an electrochemiluminescence assay including at least a compound capable of electrochemiluminescence.

12. A composition of matter for the conduct of an electrochemiluminescence assay comprising:

(a) a porous electrode having a plurality of domains; and

(b) a plurality of particles incorporated in said domains capable of complexing with a component of an electrochemiluminescence assay including at least a compound capable of electrochemiluminescence.

13. A kit for the conduct of an electrochemiluminescence assay comprising:

(a) a porous electrode having a plurality of domains and a plurality of particles incorporated in said domains capable of complexing with a component of an electrochemiluminescence assay including at least a compound capable of electrochemiluminescence; and

(b) an electrochemiluminescent label.

14. An apparatus for use in the detection of an analyte by electrochemiluminescence comprising:

(a) an electrode comprised of a conductive polymer; and

(b) a binding domain containing a reagent capable of binding a component of a binding electrochemiluminescence assay.

15. An apparatus for use in the detection of an analyte by electrochemiluminescence comprising:

(a) an electrode comprised of a metal oxide; and

(b) a binding domain containing a reagent capable of binding a component of a binding electrochemiluminescence assay.

16. An apparatus as recited in claim 15 wherein said electrode is at least partially transparent.

17. An apparatus as recited in claim 15 and wherein said metal oxide is indium tin oxide.

18. An electrode comprising a composite of:

(a) a polymer; and
(b) a multiplicity of carbon fibrils dispersed therein.

19. An electrode as recited in claim 18 wherein said composite is porous.

20. An apparatus for conducting an assay comprising;
(a) an element comprising
i) a matrix; and
ii) one or more carbon fibrils dispersed therein; and

(b) one or more binding domains containing a reagent capable of binding a component of an assay.

21. An apparatus for use in the detection of an analyte by electrochemiluminescence comprising an electrode comprised of a composite of a matrix and a multiplicity of conducting particles dispersed therein and having a binding

domain containing a reagent capable of binding a component of a binding electrochemiluminescence assay.

22. An apparatus as recited in claim 21 wherein said matrix is a polymer.

23. An apparatus as recited in claim 21 wherein said conducting particles are carbon.

24. An apparatus as recited in claim 21 wherein said conducting particle is comprised of carbon fibers.

25. An apparatus as recited in claim 21 wherein said conducting particle is comprised of carbon fibrils.

26. An apparatus for use in the detection of a plurality of analytes by electrochemiluminescence comprising:

(a) an electrode comprised of a matrix and a multiplicity of conducting particles dispersed therein; and

(b) a plurality of binding domains supported on a surface of said electrode, each domain containing a reagent capable of binding a component of a binding electrochemiluminescence assay.

27. A method for the modification of the properties of an electrode comprising a polymer and a multiplicity of carbon fibrils dispersed therein, said method comprising the step of subjecting said composite to oxidation.

28. A method for the modification of the properties of an electrode comprising a polymer and a multiplicity of carbon

fibrils dispersed therein, said method comprising the step of subjecting said electrode to a plasma.

29. A method for the modification of the properties of an electrode comprising a polymer and a multiplicity of carbon fibrils dispersed therein, said method comprising the step of derivatizing said electrode by addition of one or more functional groups therein.

30. A method as recited in claim 29 wherein the polymer is derivatized.

31. A method as recited in claim 29 wherein the fibrils contained within the composite are derivatized.

32. A method as recited in claim 29 wherein both the polymer and the fibrils contained therein are derivatized.

33. A method for treatment of a composite comprising polymer and a multiplicity of carbon fibrils dispersed therein, to alter the electrical potential at which electrochemiluminescence occurs in an electrochemiluminescent compound at said composite, comprising subjecting said composite to a chemical or physical treatment for a time sufficient to alter the said electrical potential.

34. An electrode for conducting an electrochemiluminescence assay comprising a polymer and a multiplicity of carbon fibrils, said electrode having been subjected to a chemical or physical treatment for a time

sufficient to alter the electrical potential at which electrochemiluminescence occurs.

35. A method for the modification of the properties of an electrode comprising a polymer and a multiplicity of carbon fibrils dispersed therein, said method comprising modifying said electrode to expose a desired functional group on said electrode.

36. An electrode comprising a mat of a multiplicity of carbon fibrils.

37. A mat comprised of a multiplicity of carbon fibrils and further comprising a domain containing an assay reagent.

38. A mat as recited in claim 36 having a plurality of layers of different conductivity.

39. A mat as recited in claim 36 comprised of one or more layers of derivatized carbon fibrils.

40. A mat as recited in claim 36 comprised of one or more layers of underivatized fibrils.

41. A mat as recited in claim 36 having at least one layer of underivatized fibrils and at least one layer of derivatized fibrils.

42. A mat as recited in claim 36 containing a plurality of layers of different optical opacity.

43. A mat as recited in claim 36 containing a plurality of layers of different pore sizes.

44. An electrode for use in an electrochemiluminescence assay comprising:

- (a) a support; and
- (b) a fibril mat comprising a multiplicity of carbon fibrils; and
- (c) means for making electrical contact with said mat.

45. An electrode as recited in claim 44 wherein said fibril mat has a binding domain containing a reagent capable of binding a component of a binding electrochemiluminescence assay.

46. A kit for an electrode for use in a binding electrochemiluminescence assay, comprising:

- (a) a support;
- (b) a fibril mat comprising a multiplicity of carbon fibrils; and
- (c) means for making electrical contact with said mat.

47. A kit as recited in claim 46 wherein said fibril mat has a binding domain containing a reagent capable of binding a component of a binding electrochemiluminescence assay.

48. An electrode as recited in claim 44 wherein said support is conductive.

49. An electrode as recited in claim 44 wherein said fibril mat has a binding domain containing a reagent capable of binding a component of a bind electrochemiluminescence assay.

50. An electrode as recited in claim 44 wherein said support is porous.

51. An electrode as recited in claim 44 wherein said support is comprised of a metal-coated porous material.

52. An electrode as recited in claim 44 wherein said support is comprised of a stainless steel fiber mesh.

53. A method of preparing a fibril mat for use as a support or an electrode in an electrochemiluminescent assay comprising the steps of:

(a) producing fibrils with a binding reagent immobilized on their surface;

(b) dispersing the fibrils in a medium; and

(c) filtering said fibrils from solution to produce a fibril mat.

54. A method for preparing a fibril mat for use in an electrochemiluminescence binding assay comprising the steps of:

(a) dispersing fibrils in a medium;

(b) filtering said fibrils from said medium to prepare a mat; and

(c) derivatizing the fibril mat to prepare them for immobilization of a binding reagent thereupon.

55. A method for performing an electrochemiluminescence binding assay for an analyte of interest comprising the steps of:

- (a) contacting a sample containing said analyte of interest and a label compound capable of electrochemiluminescence, with an electrode comprising a multiplicity of carbon fibrils containing a binding domain containing a reagent capable of binding a component of an electrochemiluminescence assay;
- (b) inducing the label compound at said electrode to luminesce by imposing a voltage thereupon; and
- (c) detecting the emitted luminescence.

56. A method of conducting an electrochemiluminescence binding assay for a plurality of analytes of interest in a biological sample comprising the steps of:

- (a) contacting a sample containing a plurality of analytes of interest and a label compound capable of electrochemiluminescence with a plurality of electrode zones, each of said zones comprising a fibril mat containing a domain containing a reagent capable of binding a component of an electrochemiluminescence assay;
- (b) inducing the label compound collected on said fibril mats to electrochemiluminescence; and
- (c) measuring the emitted luminescence.

57. A method as recited in claim 56 wherein said zones are in sequence and have successively smaller pore size adapted to remove successively smaller components of a biological sample.

58. A method for resolving two or more signals originating from electrochemiluminescent species in an electrochemiluminescence assay comprising: conducting said assay at an electrode having at least two zones, said zones having different electrochemical potentials at which electrochemiluminescence occurs.

59. A method as recited in claim 58 wherein a signal resolved by said method is background electrochemiluminescence.

60. A method for resolving two or more signals originating from electrochemiluminescent species in an electrochemiluminescence assay comprising: including in said assay a reagent which selectively modulates the electrochemiluminescence of one of said electrochemiluminescent species.

61. A method as recited in Claim 60 wherein said reagent quenches electrochemiluminescence from said species.

62. A method as recited in Claim 60 wherein a buffer is added to said assay which modulates the electrochemiluminescence of one of said species.

63. A method for resolving two or more signals originating from electrochemiluminescent species in an electrochemiluminescence assay for the detection or measurement of a plurality of analytes, comprising conducting said assay at an electrode which includes at least one zone which is inactive

for generating electrochemiluminescence from one or more species in said assay.

64. A method for distinguishing the signal from an electrochemiluminescent label from background signals in an electrochemiluminescence assay comprising conducting said assay on an electrode which induces electrochemiluminescence for said label and for said background, respectively, at different electrochemical potentials.

65. A method as recited in claim 64 where the electrode is a composite.

66. A method as recited in claim 64 where the electrode is comprised of carbon.

67. A method as recited in claim 64 where the electrode has been modified by chemical or physical treatment.

68. A method for distinguishing the signal from two or more species labeled with the same electrochemiluminescent compound from one another in an electrochemiluminescence assay comprising conducting said assay on an electrode which induces electrochemiluminescence from each of said labels at different electrochemical potentials.

69. A method as recited in claim 68 where the electrode is a composite.

70. A method as recited in claim 68 where the electrode is comprised of carbon.

71. A method as recited in claim 68 where the electrode has been modified by chemical or physical treatment.

72. A method for performing an electrochemiluminescence binding assay for an analyte of interest comprising the steps of:

(a) contacting a sample containing said analyte of interest and a label compound capable of electrochemiluminescence, with an electrode comprising a multiplicity of carbon fibrils containing a binding domain containing a reagent capable of binding a component of an electrochemiluminescence assay, said carbon fibrils having been modified by chemical or physical treatment to alter the electrochemical potential at which electrochemiluminescence of at least one species in an electrochemiluminescence assay occurs;

(b) inducing the label compound at said electrode to luminesce by imposing a voltage thereupon; and

(c) detecting the emitted luminescence.

73. A composite material comprising in combination (a) a matrix and (b) one or more fibrils or fibril structures the surface of which have been modified by treatment with a plasma.

74. A composite as defined in claim 73, wherein the composite material contains a multiplicity of fibrils or fibril structures dispersed in said matrix.